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ABSTRACT

In 1989, a survey was conducted of 1,003 two-year colleges and 997 four-year colleges to identify criteria used to place students into Calculus I and II, determine respondents' perceptions of the effectiveness of the placement procedures, and gather information on the first-year calculus curricula of the schools. Study findings, based on usable responses from 429 two-year colleges and 562 four-year colleges, included the following: (1) most of the responding schools based placement on either high school record, national achievement test score, or placement test results; (2) 25 two-year colleges and 3 four-year colleges did not offer calculus, 17 two-year colleges and 2 four-year colleges had no direct placement, and 70 two-year colleges and 81 four-year colleges relied on self-placement; (3) local or national placement tests were used by 58% of the schools with a placement procedure; (4) 74 two-year colleges and 176 four-year colleges used a local placement test, 77 two-year colleges and 122 four-year colleges used a commercial placement test, and 68 two-year colleges and 185 four-year colleges used a national test; (5) among schools that used a placement test developed by the Mathematical Association of America, there was no consistency in cutoff scores for Calculus I placement; (6) almost half of the colleges with placement procedures viewed placement as advisory rather than mandatory; and (7) over 60% of the respondents from both two- and four-year colleges predicted that there would be a major change in the calculus currriculum within the next 10 years. The survey instrument is attached. (AYC)

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Analysis of Placement Practices for Calculus in Postsecondary Education

Final Report

by

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INTRODUCTION

In late March, 1989, a survey (see appendix for a copy) was sent to two thousand post secondary institutions. These surveys were sent to the attention of the Calculus Coordinator. A stamped return envelope was enclosed. The first returns were received within five days. This was an indication that the topic was relevant and that the return rate would be large.

In May, a second mailing was sent to those who had not responded to the first mailing. This second mailing was sent to the attention of the Department Chair. This mailing went to one thousand institutions.

The results were tabulated over the summer. Those returns that were received before September 1, 1989, are represented in this report. Even though the survey was mailed out in March, returns are still being received in October.

The statements in the report under the heading "general comments" are verbatim responses from the surveys. They are not identified as to author or school because each institution was promised that they would not be identified in the final report.

The conclusion statements throughout the report are the author's and do not necessarily reflect the views of the Exxon Education Foundation or Embry-Riddle Aeronautical University.

Return Rate

First Mailing	778
Second Mailing	244
Duplicates	4
Unusable*	27
Useful	991

Response Rate as to Type of School

Institution	# Sent	Useful* Returned
Two Year	1003	429
Four Year	997	562

* The responses that did not identify the institution were considered unusable.

Lovejoy's College Guide was the source for the addresses of the two-year schools.

The Right College 1989 by the College Research Group of Concord, Massachusetts was the source for the four-year addresses. In this book there is a selectivity rating. This is a six point rating system going from "most competitive" to "noncompetitive." When the return rates were analyzed the results were 62% return for the most competitive, then 63%, 63%, 50%, 53%, and finally, 58% return for the noncompetitive schools. Since no group was over or under represented, this factor was not taken into account for the rest of the report.

RESULTS

Placement Practices for Calculus I:

1. **What criteria do you use for placement directly into Calculus I?**

Of the 991 schools responding, most schools base placement into Calculus I on one factor.

	2 yr	4 yr
Do Not Offer Calculus	25	3
No Direct Placement	17	2
Self Placement	70	81
One Factor*	200	248
Two Factors	100	150
Three Factors	16	55
Do Not Offer Precalculus	1	23

*Factors indicate placement test, either local or national, high school record, or ACT/SAT score.

These schools indicated the factors they considered for placement, but didn't indicate how these factors are weighted.

Eight schools indicated that they use a modeling concept to place the students. The most common is a multiple linear regression model. The most extensive model uses twelve factors, while the simplest one uses two.

Some schools use a "several factors" approach. The student must meet a cutoff score on several factors to place into Calculus I.

Another model is the "gray range" model. If a student scores above a certain level on the first factor he is placed into Calculus I. If he falls in a range below this level then the next factor is considered. If he falls below the range then he cannot be placed into Calculus I.

The most intensive program described uses a discriminate analysis technique to make placement decisions. A faculty member is granted a one-half load credit during the summer, and a one-quarter load credit in both the fall and spring semesters for placement activities. In addition student assistants are used to help with data entry and other mundane necessities. As a result of this dedication, the success rate in calculus at this school has increased from 61% to 74%.

A number of schools indicated that most (from 70% to 99%) of their students take precalculus.

769 schools were used for the responses to question #1a - d.

Two year schools - 316 Four year schools - 453

1a) **Locally produced placement test**

	2 yr	4 yr
Indicated use of a local placement test	74	176

Three two-year and seven four-year schools use a non-multiple choice format. The number of questions range from a low of 7 to a high of 39 with the average being 22.

Multiple Choice Test

	Low	Ave (SD)	High
Number of Problems			
2 yr	10	31 (13)	64
4 yr	15	39 (14)	84
Cutoff Percentage			
2 yr	36%	65% (14)	90%
4 yr	26%	63% (14)	95%

A number of schools indicated that a separate score for trigonometry is considered.

A few schools indicated that the cutoff scores are flexible or there are no particular cutoff scores. Others indicated that taking the placement test is optional.

Please include a copy of your placement test

Only 33% of the schools administering a local placement test included a copy of it. Most cited that the test is confidential. Several of the schools who did submit the test asked that it not be published. These tests have been analyzed as to the type of questions. This information is included in the appendix. Under no circumstances will any of the specific questions be published.

Of the tests that were submitted, 68 were different. These were analyzed along with the MAA/CR test as to types of questions asked.

The average mix of questions on these tests was

Algebra	69%
Geometry	12%
Trigonometry	19%.

General Comments:

- Placement test provides the student with the probability of A, B, C based on previous student performance
- Placement test does not screen out enough, < 25% place into calculus
- Borderline students invited to appeal the results of the placement test
- Students placing themselves is as good as any placement test
- Students who are placed into Calc I are usually successful, the placement test may weed out some who would have succeeded
- Placement test is an advising tool only
- The students we place into calculus generally do well. Those we force to take precalculus often still have problems.
- Students rarely study for a placement test. The result is that students do poorly on the test and place into a course that they have already had. If placement tests worked we would use them at the beginning of every course instead of relying on grades in prerequisite courses.

Conclusion:

Placement tests, both local and national, are used by 58% of the schools who have a placement procedure. This is the second most popular factor.

Precalculus is a standard prerequisite for Calculus I. When the placement tests were analyzed as to type of question, most of the questions were not at this level.

When you look at the frequency of questions asked, (see appendix) you will see that the vast majority of tests did not include questions on solving polynomials, three by three systems of linear equations, matrices, inverse trig, etc. The questions that were asked were at the beginning level in almost every area. For example, there was no question on the graphing of the trigonometric functions that looked like: Graph $y = 2 + 3 \sin(4x + 5)$.

The majority of questions on these tests are at the beginning or intermediate algebra level. Most schools indicate they use a single number cutoff score to decide between Precalculus and Calculus I. An item analysis would seem more appropriate. A student might answer most of the precalculus type of questions and miss several of the intermediate algebra type of questions. This student's problems will not be cured by being placed into Precalculus.

An interesting experiment might be to give the placement test to all students who passed Precalculus the semester before to see if they can still preform at an acceptable level to register for Calculus I. If the reasons are sound for keeping the entering student out of Calculus I based on a placement test, then these same reasons should apply to any student who wishes to register for Calculus I.

1b) **Commercial Placement Test - MAA/CR, ASSET, MAPS, etc.**

	2 yr	4 yr
Indicated use of a commercial placement test	77	122
Most Popular		
MAA/PTP[1]	27	85
ASSETT	17	1
MDPT[2]	13	5
MAPS	4	7
ETS/DTMS[3]	8	13

[1] Mathematical Association of America Placement Testing Program - any form. If the institution indicated they had used a cut and paste of the MAA tests, then this was considered a local test.

[2] Mathematics Diagnostic Testing Project - prepared with the support of the California State University, the University of California, and the California Academic Partnership Program. Copyright 1986 - The Regents of the University of California and The Trustees of the California State University.

[3] Educational Testing Service/Descriptive Test of Mathematical Skills

Other tests that were mentioned in this category - New York Regents, McGraw Hill, Missouri Math Placement Test, ACT Placement Test, Addison Wesley Cooperative Test Of Mathematical Skills, New Jersey Basic Skills Test

The most popular test is the MAA/Calculus Readiness Test.

		Cutoff Scores		
MAA/CR	Number	Low	Ave (SD)	High
2 yr	18	12	16 (3)	21
4 yr	53	9	14 (4)	20

Conclusion:

When the cutoff scores on the MAA/CR test were compared with the curricula, there was no consistency. For example, one school used a cutoff of 10 for Calculus I while a second school used a cutoff of 20, but they used the same text and the same syllabus for Calculus I.

There are two philosophies governing placement. The first is a liberal policy which allows everyone in who has any chance to pass. The cutoff score is low, and the failure rate for the course may be high. Using this philosophy under places a minimum number of students.

The second is the conservative policy which allows no one in who has a chance to fail. Several schools stated that in borderline cases they would conservatively place the student. Here the cutoff score is high and, hopefully, the failure rate for the course is low. The drawback here is that a large number of students may be under placed.

Both of these policies have serious drawbacks. Since no placement test is going to accurately place every student, why do these tests continue to have so much credibility?

1c) High school record - GPA, high school rank, grades and type of math courses, etc.

	2 yr	4 yr
Indicated use of high school record	248	285
Specific use indicated	107	160
Type of math courses	107	153
Grades in math	70	71
Overall GPA	13	26
High school rank	9	21

Trigonometry was the course mentioned most often. Other senior courses that were heavily mentioned were precalculus, analytic geometry, math analysis, college algebra, advanced algebra with trigonometry, and senior math.

The range of grades in high school math required for placement into Calculus I go from 2.0 to 3.5 with 3.0 being the most prevalent.

The number of years of high school math desired goes from two years to five years with four years being predominant.

Most mentioned combination - four years of high school math including trigonometry with a math GPA of 3.0

Other popular versions -

3.5 overall GPA with a B in precalculus
4 years of math with a B in the last
College algebra and trigonometry with a B
Precalculus with a C

Least stringent - algebra I and algebra II

Most stringent - Top 10% of high school class and either an A in high school calculus or a 3 on the AP test

Recent math courses was mentioned a few times.

Mentioned once -

Recommendation of principal
Articulation agreement with the high school
High school graduated from
Physics and chemistry grades considered

General Comments:

High schools are failing badly, students make good grades, but learn little.
High school record used for borderline cases
Students without sufficient background rarely complete the calculus program
Math should not be a matter of choice for high school students

Conclusion:

Seventy-eight percent of the two year schools and sixty-three percent of the four year schools indicated that they use the high school record in placement (69% overall). This is more than any other factor. This shows that there is still a lot of faith being placed in the high schools, but there could be more.

Those colleges with a local student body could set up articulation agreements with their feeder high schools. If this were in place, then there would be no need for elaborate placement procedures. This is more difficult for colleges with regional or national student bodies. This whole idea of placement could become a moot point if there were a more standard high school curriculum. This may be coming when more schools adopt the NCTM Standards.

1d) National test - SAT/M, ACT/M, ACT/Comp, etc

	2 yr	4 yr
Indicated use of a national test	68	185
Specified type	63	170
SAT/M	29	92
Least	350	400
Ave (SD)	530 (70)	540 (60)
Most	600	650
ACT/M	48	93
Least	20	15
Ave (SD)	25 (2)	25 (3)
Most	29	30

Other national tests used and scores -

SAT combined - 1000 to 1100
ACT Comp - 28
SAT ACH - 550 - 600

Two schools have different cutoff scores for males and females. One has a 500 SAT/M for males and a 430 for females. The other has a 20 ACT/M for males while the cutoff for females is 17.

Two schools indicated that they use the ACT test to screen to take the placement test.

General Comments:

- SAT-V and rank in high school are the best predictors of success
- SAT looked at for borderline cases
- Ninetieth percentile on ACT or SAT exempts student from placement test
- Some time in the future a study should be made of the ACT M and Natural Science scores of those that are successful in the calculus sequence. You might be surprised to see that a score will crop up below which so few students pass the course that students below that score should not be encouraged to take calculus.

Conclusion:

There seems to be less credence given to the results of these tests. Only thirty-three percent of the schools with placement programs take these scores into account when making a placement decision for Calculus I.

Are the scores on these tests really an indication of how well a student will perform in calculus? Have any large studies been made on the correlation between these scores and success in calculus? Do these scores tell us anything that cannot be learned form the high school record?

2. If a student <u>does not</u> meet the cutoff score to place into Calculus I, which of the following best describes his/her chance of gaining admittance to the course?

	Good, placement is advisory	Poor, student may appeal	Impossible placement is mandatory
2 yr	46%	41%	13%
4 yr	52%	37%	11%

Several schools indicated they have a drop back policy. The time period for dropping back varies from one week to six weeks. Others indicated that the student can repeat the placement test or take a second version of the test.

General Comments:

Advised by the math faculty
Advised by the major department
Many are placed by ill informed advisors
Mandatory placement through College Algebra
A look at the High School record may overturn a poor placement test score
Interview in conjunction with a placement test
Additional placement test given the first day of class
Placement is advisory. Most students take their advisor's recommendation. Very few take calculus when algebra is recommended. Those taking algebra when calculus is recommended are a bigger problem.
No barriers to taking Calculus
Easy to beat the system, non-qualified rarely pass.
Students are strongly advised to take placement test advice

Conclusion:

Almost half of the schools who have placement programs view placement as advisory and another 151 schools let the students place themselves. This shows that a large number of schools let the students control their course selection.

If the first math course in a student's degree program is Calculus I, does the faculty really have the right to add courses to this program without the student's consent? This is exactly what is being done when this student is placed below Calculus I with no right to appeal or the appeal process is very difficult.

Students deserve to have the last say in regard to the courses they take. This doesn't mean that the faculty should not be advising students. On the contrary, the faculty should be giving the student as much help as possible in making the choices, as long as this advice is based on valid studies and not on whim.

3. **How do you rate the effectiveness of your placement system for Calculus I?**

	Outstanding	Adequate	Poor
2 yr	8%	83%	9%
4 yr	11%	80%	9%

Several schools indicated that they are in their first year of a new placement program or are changing their system for next year. Some are revising their placement tests or revising their cutoffs. Some indicated that their failure rate of 10% to 20% indicates that their placement program is working.

A comparison of the outstanding and poor programs by method of placement -

	Outstanding	Poor
Self Placement	8%	39%
One Factor	55%	37%
Two Factors	29%	21%
Three Factors	8%	3%

Of the eight schools who indicated a modeling approach, five rate their program outstanding and none rate theirs poor.

One of the outstanding schools who uses only the high school record uses a placement test for appeals.

Forty of the outstanding schools use a local placement test while only nine of the poorly rated ones do. One of the poorly rated schools indicated that their placement test isn't worth using while another indicated they are changing to ASSETT.

General Comments:

Follow-up results are mixed when comparing the placement test score with the score on the first exam

The math faculty used to place the incoming students with good results. Now the faculty advisors place the students and this has not been effective.

Conclusion:

Placement practices for Calculus I vary from institution to institution. These practices vary from no policy to very elaborate procedures. All in all most institutions are satisfied with their placement procedures for Calculus I, but are continually evaluating their system and are willing to update it if they see a need.

Placement Practices for Calculus II:

4. What criteria do you use for placement directly into Calculus II? (exclude transfer credit)

Of the 403 two year schools offering Calculus II only 163 (40%) have a method by which a student can place directly into Calculus II. On the other hand, 428 (77%) of the 559 four year schools offering Calculus II have a method. A large number of schools indicated that there is no way a student can place directly into Calculus II while another equally large number indicated that the only way to register for Calculus II is to pass Calculus I. (Some indicated that a student must earn at least a "C" in Calculus I to register for Calculus II.)

Method of Placement into Calculus II

	2 yr	4 yr
Self placement	10	4
Permission of Instructor	4	4
Interview	25	42
Local Test	37	94
High School Record	22	36
CLEP	16	30
AP Test	65	292

The reason the number of schools doesn't add up is because several schools have an "or" policy. (ie., either the AP test or a local test)

Scores receiving credit for Calculus I on the AP test:

Form AB	Low	Average	High
2 yr	2	3.4	5
4 yr	2	3.4	5
Form BC*			
2 yr	2	3.3	5
4 yr	2	3.2	5

* This is possibly misleading since a number of schools indicated that a score of 3 or better on the BC test allows the student to get credit for both Calculus I and Calculus II and be placed directly into Calculus III.

One school indicated that for a transfer student to receive credit for Calculus I and register for Calculus II he must have an A or B in Calculus I.

Students self placing into Calculus II without credit for Calculus I are either awarded advanced standing for Calculus I after passing Calculus II or are given full credit for Calculus I if they receive at least a C in Calculus II.

Conclusion:

The number of schools that don't have a policy for direct placement into Calculus II is surprising. One explanation for this is that these schools may not be getting a large influx of students who had calculus in high school. For those schools that allow direct placement, the AP test seems to be firmly entrenched.

FIRST YEAR CALCULUS CURRICULUM

1. Indicate text and author used.

A list of the rank ordering of the top 25 authors is included in the appendix. This is based on the response of 882 post-secondary institutions. Some institutions did not respond to the question on text used and others did not offer calculus. Those authors used by only a few schools have not been included.

General Comments:

We need smaller books

The texts should treat the topics in the same order

Conclusion:

The top authors appear to be well entrenched. The only text in the top ten that is in the first edition is the one by Stewart.

2. What is your first year curriculum?

Semester Hours Given for First Year Calculus (quarter hours have been translated to semester hours and rounded)

	Total Number of Hours (two semesters)					
	6	7	8	9	10	12
2 yr	28	5	140	15	201	2
4 yr	80	10	258	18	96	2

Variations on straight lecture:

Calculus meets for 5 periods for 4 credits

3 hours of lecture and 2 of recitation for 3 credits

2 tracks, slow and fast, catch up during 6 week winter term

An analysis of 415 curricula is included in the appendix. Those schools that offer either a 3-3, 4-4, or 5-5 semester hour sequence for the first year and use a text by one of the top ten authors were analyzed. The list of topics is not meant to be all inclusive, but rather is intended to give a flavor of what schools on the same semester credit setup consider to be first year topics.

Each of these schools has as a part of Calculus I limits, derivatives, derivatives of at least sine and cosine, and applications of the derivative. Where they differ is in what else they cover in Calculus I.

The most common topic in Calculus II is techniques of integration. A few schools cover this in Calculus I and few others do not get this far in two semesters.

Conclusion:

There is anything but a standard curriculum for the first two semesters of calculus, both in the amount of credit given and in the topics covered. Common curricula occurred between schools offering Calculus I for 3, 4, or 5 credits. Five hour curricula did not necessarily cover more material than did the three or four hour curricula.

In sheer amount of material covered one school on the 3-3 system covered the most. In two semesters, all of the material in the calculus text was covered, plus there was an introduction to linear algebra.

NOTE: When the respondents were answering the preceding questions, they were speaking about their school's policy for placement and their curriculum. When the respondents answered the following questions, they were speaking as individuals and not necessarily as a representative of their school or faculty. However, some credence must be given to the answers to the following questions because the respondent was either the calculus coordinator or the department chair.

3. Do you believe the calculus curriculum is in need of a major change?

	Yes	No
2 yr	44%	56%
4 yr	57%	43%

General Comments:

No agreement on what to remove!
Smaller classes, more participation of students in class
One major problem is large class size
More computer less algorithms
Need more pertinent applied problems
Instruction is in need of a major change
It's hard to see what all the agitation is about
You cannot remove rigorous, essential material from calculus and then expect students to know as much as ever and be able to solve problems that are just as hard
The "Modern Math" of the 60's damaged mathematics education in the USA. I hope the "New Calculus" doesn't finish the job.
Problem is with the student's poor background
Much of calculus is antiquated, especially integral calculus
We try to cover too much material
Teaching methods need change, not content
The trouble has very little to do with the curriculum. The teacher is much, much more important. Why do we continue to misplace the problem?
We should be moving toward a technology-based, conceptual calculus curriculum, but more work has

to be done to define what is meant by a conceptual approach to calculus. There seems to be no consensus as to what is meant by conceptual calculus.

Conclusion:

There is a mixed message in the answers to this question. Where some feel a change was in order, others feel that by changing calculus you may end up with a course that doesn't fit anyone's needs.

There is also a strong contingent of faculty who feel that teachers and students need changing and not the curriculum.

4. **Do you believe a major change will occur in the calculus curriculum within the next ten years?**

	Yes	No
2 yr	61%	39%
4 yr	66%	34%

General Comments:

Change will occur due to graphics calculators and symbolic software

Maple software, etc. will revolutionize the calculus curriculum in the next ten years

Most faculty are too entrenched to bother

Some change in calculus can be beneficial. The new technology can be used. However, there is a real risk of introducing a new learning disability by unwise use of the computer: computer assisted mathematical incompetence.

Conclusion:

There seems to be some consensus that computers and graphics calculators need to be incorporated into the curriculum. Where is the money for this hardware going to come from? Are colleges going to fund the math departments for labs in the same way physics, chemistry, and computer science departments are currently funded?

In the last 20 years a change has occurred in the calculus sequence. Where early trigonometry used to occur in an author's alternate edition now the alternate edition of the text by Larson and Hostetler is late trigonometry.

5. **Are you in favor of a standardized national curriculum?**

	Yes	No
2 yr	50%	50%
4 yr	28%	72%

General Comments:

We almost have a standard curriculum
Most texts force a national curriculum
Don't we already have a standardized national curriculum in reality?
National guidelines with local autonomy
Recommended national curriculum - I prefer an applications course with the use of computers
Standardized for total content, not semester by semester
Standard curriculum along NCTM Standards
National standard would dilute the few good courses, ours is a good course

Conclusion:

It is easy to see why more of the two year colleges want a standardized calculus curriculum. They are concerned with transferability where the four year school isn't as concerned with this issue.

Another feeling that came out of this question was that a national curriculum would water down the calculus. Several schools thought the problem was with other school's courses and not with their own.

6. **How much of the following books have you read?**

a) <u>Toward a Lean and Lively Calculus</u>

	All	Most	Some	None
2 yr	10%	11%	22%	57%
4 yr	17%	24%	33%	26%

General Comments:

Like Stein's "What's All The Fuss About?"

b) <u>Calculus for a New Century</u>

	All	Most	Some	None
2 yr	8%	7%	18%	67%
4 yr	12%	18%	31%	39%

General Comments:

No change here, maybe in schools complained about in these books

Conclusion:

With all of the press about the proposed change in calculus in recent years, it is surprising that these percentages weren't higher. Supposedly these surveys were filled out by either the person in charge of calculus or by the department chair.

Outside of those schools receiving funding from NSF for calculus reform, how many schools have made an effort to change the way they are teaching calculus?

Overall General Comments:

Calculus should not be
1) a primer for Real Analysis
2) a subsidiary of General Physics
3) a course in Computer Science
4) an opportunity to play passively with Computer Graphics

Calculus can, of course, cooperate with #1, 2, & 3.

To have greater success in teaching calculus, we need to change not the curriculum but how and to whom we deliver it.

1) Be realistic about those who should be taking calculus. Too many curricula are using calculus as a screening device of students for whom a study of this course is irrelevant. Concentrate on the majors in those areas on which this mathematics has some bearing.
2) Give these students careful and adequate preparation: courses in advanced algebra, analytic geometry, functions and graphing. Finally, abandon the large lecture hall approach: let classes be small enough to permit discourse between student and instructor (c. 25 students).

We regard Calculus I as the proper first course at the college level, and only reluctantly offer a Precalculus course. (Anything lower is outright fraud for College credit!)

Many of the students who "fail" Calculus are simply making a legitimate decision to pursue some other discipline or to opt out of academic life. I do not consider this a failure. 50% of the students who start a very difficult process succeed one year later. I believe this is comparable to the percent success in piano lessons or running or anything else that takes dedication.

We discourage most students from starting with calculus. For most of our students the first year consists of college algebra, trigonometry, and analytic geometry. The second year is three quarters of calculus. It is assumed that analytic geometry has been learned and it is used, but not taught the second year. Our success rate in calculus is over 90% with most of these students earning A's or B's.

OVERALL CONCLUSIONS

Each institution has its own view of calculus. The calculus curriculum is very well entrenched. There seems to be little hope of a sweeping change taking place in calculus in the near future. There will be some change to incorporate computers and hand held graphic calculators, but these will be on an institution by institution basis and will be slow in coming. Major money will have to be made available to equip the faculty and the students with the necessary hardware.

Interest in the calculus curriculum seems to have peaked. The high percentage of the faculty in charge of the calculus curriculum who are not even staying abreast of the proposed changes is alarming. This is evidenced by the number of faculty that have read neither of the books concerned with change. Even though the return rate on this survey was good, there were still 1,000 institutions who chose not to reply. Most institutions are in a wait and see category or are satisfied with the status quo.

There are two ways that a sweeping change could occur in the calculus curriculum. NSF, with all of its money, cannot affect a change. The calculus textbook authors could dictate curriculum reform by paring down their texts. This won't happen. The other way is for the departments that are serviced by the calculus to demand that the mathematics departments teach a different course or else they will start teaching calculus. When this happens the mathematics departments will be faced with such a large loss of revenue that they will have to change.

The End

SURVEY - PLACEMENT PRACTICES IN CALCULUS

_____

Institution Campus

PLACEMENT

Calculus I:

1. Which of the following criteria do you use for **placement directly into** Calculus I? Check all that apply.

_____ a) Locally produced placement test - cutoff score _____

Please include a copy of your placement test

_____ b) High School record - GPA, high school rank, grades and type of math courses, etc. Be specific.

_____

_____

_____ c) National test - SAT/M, ACT/M, ACT/Comp, etc.

Test/Form _____ cutoff score _____

_____ d) Commercial Placement Test - MAA/CR, ASSET, MAPS, etc.

Test/Form _____ cutoff score _____

_____ e) All take Calculus I - no precalculus courses offered

_____ f) No placement criteria - students place themselves

2. If a student **does not** meet the cutoff score to place into Calculus I, which of the following best describes his/her chances of gaining admittance to the course?

___ Good, placement is advisory ___ Poor, student may appeal ___ Impossible placement is mandatory

3. How do you rate the effectiveness of your placement system for Calculus I?

____ Outstanding ____ Adequate ____ Poor

(over)

Calculus II:

4. Which of the following criteria do you use for advanced placement directly into Calculus II?

_____ a) National Test - AP/AB, AP/BC, CLEP, etc.

Test/form _____ cutoff score _____

_____ b) Locally produced placement test

_____ c) Other _____

FIRST YEAR CALCULUS CURRICULUM

1. Text _____
author edition publisher

2. a) Semester calendar - credit hours ____ - ____

Chapters covered Calculus I _____

Chapters covered Calculus II _____

b) Quarter calendar - credit hours ____ - ____ - ____

Chapters covered Calculus I _____

Chapters covered Calculus II _____

Chapters covered Calculus III _____

3. Do you believe the calculus curriculum is in need of a major change? yes no

4. Do you believe a major change will occur in the calculus curriculum within the next ten years? yes no

5. Are you in favor of a standardized national calculus curriculum? yes no

6. How much of the following books have you read?

a) Toward a Lean and Lively Calculus all most some none

b) Calculus for a New Century all most some none

7. Comments: _____

_____

Sixty-nine Placement Tests
Frequency of Type of Question Asked

Topic	No Question	One Question	Two or More Questions
ALGEBRA			
Polynomial Arithmetic	36%	26%	38%
Rational Arithmetic	14%	10%	75%
Factoring	33%	39%	28%
Linear Equations	41%	26%	33%
Quadratic Equations	14%	32%	54%
Rational Expressions	52%	36%	12%
Absolute Value Equations	72%	22%	6%
Equations with Radicals	77%	17%	6%
Linear Inequalities	59%	36%	4%
Quadratic Inequalities	61%	36%	3%
Absolute Value Inequalities	54%	45%	1%
Simplify Exponents	35%	30%	35%
Arithmetic with Exponents	35%	41%	25%
Rationalize Denominator	68%	30%	1%
Simplify Radicals	52%	39%	9%
Complex Arithmetic	88%	10%	1%
Evaluate functions	25%	36%	39%
Composition	59%	33%	7%
Graph Functions	75%	20%	4%
Domain and Range	64%	33%	3%
Graph Absolute Value	90%	10%	0%
Variation	74%	16%	10%
Inverse Function	86%	13%	1%
One-to-one	99%	1%	0%
Graph Inverse	99%	1%	0%
Other Graphing	91%	9%	0%
Polynomial Equations	80%	13%	7%
Graphing Polynomials	97%	3%	0%
Graphing Rational	90%	9%	1%
Rational Inequality	94%	6%	0%
Conjugate Root Theorem	99%	1%	0%
Logs	20%	32%	48%
Exponentials	55%	33%	12%
Graphing Logs	87%	13%	0%
Graphing Exponentials	71%	28%	1%
Linear Systems, 2 by 2	49%	41%	10%
Linear Systems, 3 by 3	96%	4%	0%
Nonlinear Systems	84%	16%	0%
Determinants	96%	4%	0%
Systems of Inequalities	97%	3%	0%
Cramer's Rule	99%	1%	0%
Matrices	99%	1%	0%
Mathematical Induction	99%	1%	0%
Summation	96%	4%	0%
Sequences	94%	3%	3%
Series	96%	4%	0%
Factorial	97%	3%	0%
Binomial theorem	90%	10%	0%
Probability	97%	3%	0%

Topic	No Question	One Question	Two or More Questions
GEOMETRY			
Distance Between points	71%	29%	0%
Area/Perimeter	68%	22%	10%
Graph Line	59%	33%	7%
Equation of a Line	68%	30%	1%
Slope/Intercept	57%	32%	12%
Parallel/Perpendicular	75%	22%	3%
Graph Parabola	43%	51%	6%
Graph Other Conic	74%	19%	7%
Similar Triangles	86%	13%	1%
Solid Geometry	87%	13%	0%
Other Plane Geometry Theorem	93%	4%	3%
TRIGONOMETRY			
Radian	70%	26%	4%
Evaluate Trig Expressions	28%	20%	52%
Trig Equation	51%	35%	14%
Trig Graphs	42%	39%	19%
Right Triangle	52%	26%	22%
Trig Identities	36%	42%	22%
Inverse trig	80%	13%	7%
DeMoive's theorem	99%	1%	0%
Law of Sines and Cosines	80%	17%	3%
Interpolation	97%	3%	0%
Trig Form of Complex Number	97%	1%	1%
Polar Coordinates	99%	0%	1%
Vectors	99%	1%	0%

Calculus Syllabi

3-3 Sequence	1st Sem Calculus			2nd Sem Calculus		
	2 yr	4 yr	Total	2 yr	4 yr	Total
Antiderivatives	65%	66%	66%	35%	34%	34%
Definite Integral	65%	43%	49%	35%	57%	51%
L'Hopital's Rule	29%	21%	23%	53%	49%	50%
Numerical Integration	29%	13%	17%	65%	79%	76%
Application Def. Int.	29%	11%	16%	71%	85%	81%
Logs	24%	8%	11%	76%	89%	86%
Exponentials	18%	4%	7%	82%	91%	89%
Inverse Trig	18%	2%	6%	82%	94%	91%
Techniques of Int.	0%	2%	1%	100%	92%	94%
Improper Integrals	0%	2%	1%	82%	60%	66%
Conics	6%	4%	4%	47%	13%	21%
Polar	0%	0%	0%	41%	15%	21%
Infinite Series	0%	0%	0%	47%	32%	36%
Power Series	0%	0%	0%	35%	30%	31%
Vectors 2-D	0%	0%	0%	6%	9%	9%
Vectors 3-D	0%	0%	0%	6%	6%	6%
DE	0%	0%	0%	6%	6%	6%
Vector Valued Functions	0%	0%	0%	0%	4%	3%
Linear Algebra	0%	0%	0%	0%	2%	1%
	17 Two Year Schools			53 Four-Year Schools		
4-4 Sequence						
Antiderivatives	97%	96%	96%	2%	4%	3%
Definite Integral	89%	93%	91%	11%	7%	9%
L'Hopital's Rule	12%	17%	15%	79%	79%	79%
Numerical Integration	22%	31%	28%	77%	68%	71%
Application Def. Int.	41%	46%	44%	59%	54%	56%
Logs	33%	23%	27%	66%	77%	73%
Exponentials	23%	19%	20%	76%	81%	79%
Inverse Trig	20%	13%	16%	79%	87%	84%
Techniques of Int.	2%	3%	3%	98%	95%	96%
Improper Integrals	1%	3%	2%	96%	93%	94%
Conics	1%	3%	3%	74%	53%	61%
Polar	1%	1%	1%	56%	60%	58%
Infinite Series	1%	0%	<1%	73%	75%	74%
Power Series	1%	0%	<1%	66%	72%	70%
Vectors 2-D	0%	0%	0%	18%	16%	17%
Vectors 3-D	0%	0%	0%	15%	13%	14%
DE	1%	1%	1%	1%	9%	6%
Vector Valued Functions	0%	0%	0%	5%	5%	5%
Partial Derivatives	0%	0%	0%	4%	2%	3%
Multiple Integrals	0%	0%	0%	2%	3%	3%
Vector Calculus	0%	0%	0%	1%	1%	1%
	91 Two-Year Schools			149 Four-Year Schools		

5-5 Sequence	1st Sem Calculus			2nd Sem Calculus		
	2 yr	4 yr	Total	2 yr	4 yr	Total
Antiderivatives	100%	98%	99%	0%	2%	1%
Definite Integral	98%	96%	97%	2%	4%	3%
L'Hopital's Rule	30%	16%	24%	63%	80%	70%
Numerical Integration	46%	53%	50%	54%	45%	50%
Application Def. Int.	68%	57%	63%	32%	43%	37%
Logs	29%	33%	30%	71%	67%	70%
Exponentials	23%	33%	28%	77%	67%	72%
Inverse Trig	13%	29%	20%	86%	71%	79%
Techniques of Int.	2%	18%	10%	98%	82%	90%
Improper Integrals	0%	16%	8%	98%	84%	91%
Conics	7%	4%	6%	80%	82%	90%
Polar	0%	2%	1%	80%	76%	78%
Infinite Series	0%	0%	0%	82%	84%	83%
Power Series	0%	0%	0%	79%	84%	81%
Vectors 2-D	4%	2%	3%	34%	49%	41%
Vectors 3-D	4%	2%	3%	20%	47%	32%
Vector Valued Functions	2%	0%	1%	14%	37%	25%
Partial Derivatives	0%	0%	0%	9%	18%	13%
Multiple Integrals	0%	0%	0%	7%	14%	10%
Vector Calculus	0%	0%	0%	0%	6%	3%

56 Two-Year Schools 49 Four-Year Schools

Rank Ordering of the Top 25 Calculus Authors

The following list is a rank ordering of the texts used by 882 post-secondary institutions. Some institutions did not respond to the question on text used and others did not offer calculus. Those texts used by only a few schools have not been included.

Author	Rank 2 yr	Rank 4 yr	Overall Rank
Anton	2	1	1
Larson & Hostetler	1	4	2
Swokowski	3	2	3
Thomas & Finney	4	3	4
Purcell & Varberg	5	5	5
Stewart	9	8	6
Ellis & Gulick	14	7	7
Salas, Hille, & Anderson	15	6	7
Berkey	8	10	9
Leithold	6	12	10
Stein	10	11	11
Riddle	7	17	12
Edwards & Penney	20	9	13
Faires & Faires	10	17	14
Zill	13	16	15
Grossman	15	13	16
Mizrahi & Sullivan	12	19	16
Munem & Foulis	15	13	16
Gillett	20	13	19
Shenk	19	22	20
Simmons	24	20	21
Fraleigh	20	21	22
Hunt	18	24	23
Holder	20	25	24
Hurley	25	22	24

The top 5 authors have 50% of the total adoptions, while the top 10 authors account for 70% of the total.

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